

Exploring s



scientific literacy



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Photo by Terry Osborne

*Australia has a world-class education system, according to the latest results from the Programme for International Student Assessment, as **Sue Thomson** explains.*

In 2006, more than 14 000 15-year-old students from 356 schools across Australia took part in the third cycle of the Programme for International Student Assessment (PISA). Schools were randomly selected from all schools in Australia and about 50 students were randomly selected for participation in each school. These students represented Australia in what has become known as the world's biggest assessment, with a total of 400 000 students in 57 countries participating in PISA 2006, including all countries in the Organisation for Economic Cooperation and Development (OECD) and 27 others, ranging from Azerbaijan to Uruguay.

The OECD considers that mathematics, science and technology are so pervasive in modern life that it is important for students to be literate in each of these areas, as well as in reading. Clearly there are many more skills in which PISA is interested than could be measured in each three-yearly survey, so a different domain is chosen to be the focus for each assessment. Reading literacy was the major domain in PISA 2000, mathematical literacy in PISA 2003, and scientific literacy in the PISA 2006 assessment. In each cycle the two other domains are also measured, albeit not as comprehensively, while measurement of technological capabilities is embedded in each assessment.

The main questions driving PISA are focused on the future. How well are young adults prepared to meet the challenges of the future? Do they have the skills needed to adapt to rapid social change?



Other questions focus on schools and their influence on student outcomes. Are some ways of organising schools and school learning more effective than others? How equitable is education provision for students from all backgrounds?

To begin answering these questions, PISA asks students to apply their knowledge and skills to real-life problems and situations. Faced with problem situations that might occur in real life, can they analyse, reason and communicate their ideas effectively? Do they have the capacity and are they equipped with strategies to continue learning throughout their lives?

PISA 2006 results suggest that most Australian students are well equipped to meet these challenges. Overall, Australian students scored significantly higher than the OECD average in each of scientific, reading and mathematical literacy. Three countries significantly outperformed Australia in science, eight in mathematical literacy and five in reading. Australia's position has deteriorated from PISA 2000, when only one country outperformed us in reading and mathematics and two in science.

In addition to the mean scores for countries, PISA has developed proficiency levels to add meaning to performance. Descriptions were developed to summarise the kinds of scientific competencies associated with different levels of proficiency.



As a set, these describe growth in scientific literacy. At the highest level, Level 6, students can “consistently identify, explain and apply scientific knowledge and knowledge about science in a variety of complex life situations.” At Level 5, students are able to construct explanations based on evidence and arguments based on their critical analysis, as well as to use well-developed inquiry abilities, to link knowledge appropriately and to bring critical insights to situations.

At the lower levels of achievement, for example at Level 2, students may be able to identify the key features of a scientific investigation, recall single scientific concepts and information related to a current event, and use results of a scientific experiment represented in a data table as they support a personal decision. Students at Level 1, on the other hand, often confuse key features of an investigation, apply incorrect scientific information, and mix personal beliefs with scientific facts in support of a decision. Level 2 is defined as the baseline proficiency level: students performing below this level are at risk of being unable to participate effectively in the 21st-century workforce.

The good news is that the proportion of Australian students achieving in the highest two proficiency levels is as high as any in the world, other than Finland, where 21 per cent of students were at this level. In

other countries whose average score was higher than Australia's, the proportion of students in the higher proficiency levels was roughly the same – 16 per cent for Hong Kong-China and 14 per cent for Canada, compared to 15 per cent for Australia. The bad news, however, is that these countries have more success in getting students past the minimum levels, particularly Finland, where only 5 per cent of students were failing to achieve proficiency Level 2, compared with 13 per cent of Australian students.

These high levels of achievement are, however, an average over all Australian students, and unfortunately there are some areas of real inequity in our education system. Australia's lowest-performing students are most likely to come from Indigenous communities, geographically remote areas, and poor socioeconomic backgrounds. Around 40 per cent of Indigenous students, 23 per cent of students from the lowest category of socioeconomic status, and 27 per cent of students from remote schools are not achieving at the baseline proficiency level for scientific literacy defined by the OECD as sufficient in order to participate fully in the 21st-century workforce and society.

There are schools catering to students from remote, Indigenous and low-socioeconomic backgrounds that do perform well – and

these examples may provide the key to improvement across the entire education system. Provision of high-quality teaching and resources to all students, as modelled on examples of current best practice in Australian classrooms, is the surest way to raise the achievement level of Indigenous, remote and poor students.

The recent PISA results have shown that Australia does have a world-class education system – for most students – but that we have much work to do to address issues of inequity and ensure access to quality education for all students.

The full Australian PISA 2006 report, *Exploring Scientific Literacy: How Australia measures up*, by Sue Thomson and Lisa De Bortoli, is available at www.acer.edu.au/pisanews ■